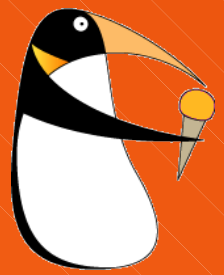


Numerical Computation Tools for Itanium

by:
Shailesh Patel
Matthieu Delahaye

About Us

- Software Engineers at Gelato Central Operations
- Working on Vanilla: make available highly-optimized binaries for critical Linux utilities on the Linux Itanium platform and to give developers tips to create efficient binaries.
- http://co.gelato.org/vanilla

gelato.org
Advancing Linux Itanium

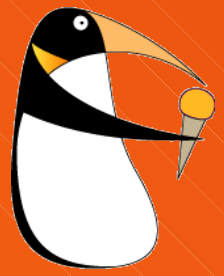
MATLAB by MathWorks

- MATLAB = MATrix LABoratory
- Invented in late 70s by Cleve Moler (University of New Mexico)
- Rationale: Using LAPACK and EISPACK without learning FORTRAN.
- “A high performance language for technical computing.”
- Today includes variety of toolboxes (e.g. Signal Processing, Image Processing, Spline, Symbolic Math)

Two Main Issues

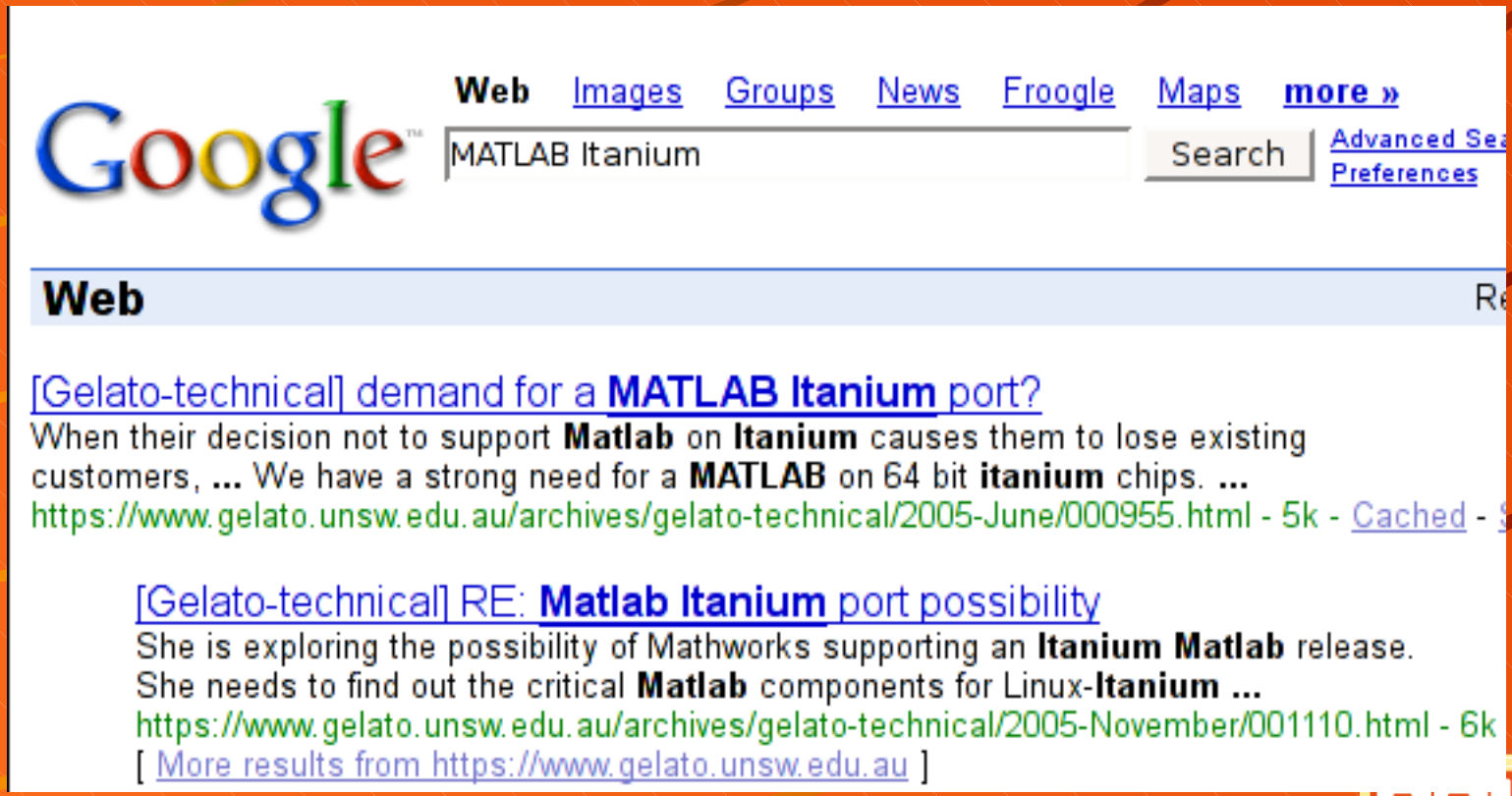
- Expensive:
  - Full version: 2000$
  - Academic, limited, license: 100$
- No version for Itanium-based platforms available (yet?)
- Typical case of vendor lock-in/lock-out.

Price source: Wikipedia



Why speaking about it?

- According to Google*, Gelato.org is on top of it...



*: Google is a claimed trademark by Google

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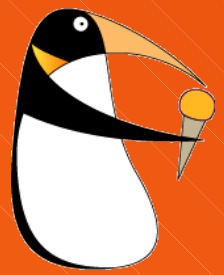


Scilab*

- Originally co-developed by INRIA and ENPC
- Now maintained by the Scilab* Foundation
- Performance “Über alles”, not compatibility
- Syntax: Translators (“mfile2sci” and “translatepaths”)
- Some find the documentation “excellent”
- Large set of Toolkit

Visit www.gelato.org

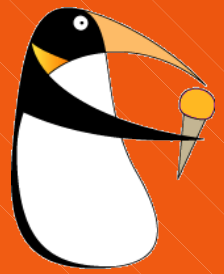
Scilab Toolkits

- broad spectrum open source software package for numerical computation
  - 2-D and 3-D graphics, animation
  - Linear algebra, sparse matrices
  - Polynomials and rational functions
  - Interpolation, approximation
  - Simulation: explicit and implicit systems of differential equations solution
  - Classic and robust control, LMI optimization
  - Differentiable and non-differentiable optimization
  - Signal processing
  - Graphs and networks
  - **Parallel Scilab using PVM**
  - Statistics
  - Interfaces with Computer Algebra (Maple, MuPAD)
  - Interface with TCL/TK

Who is using Scilab?

- Research & Academia: ENPC, INRIA, CEA, Ecole Polytechnique
- Space and Defense: CNES, EADS, Dassault Aviation, Thales
- Electronic & Embedded systems: Anagram Technologies, Klippel, TNI
- Automobile: Renault, Peugeot PSA Citroen(???)

source: www.scilab.org



GNU Octave

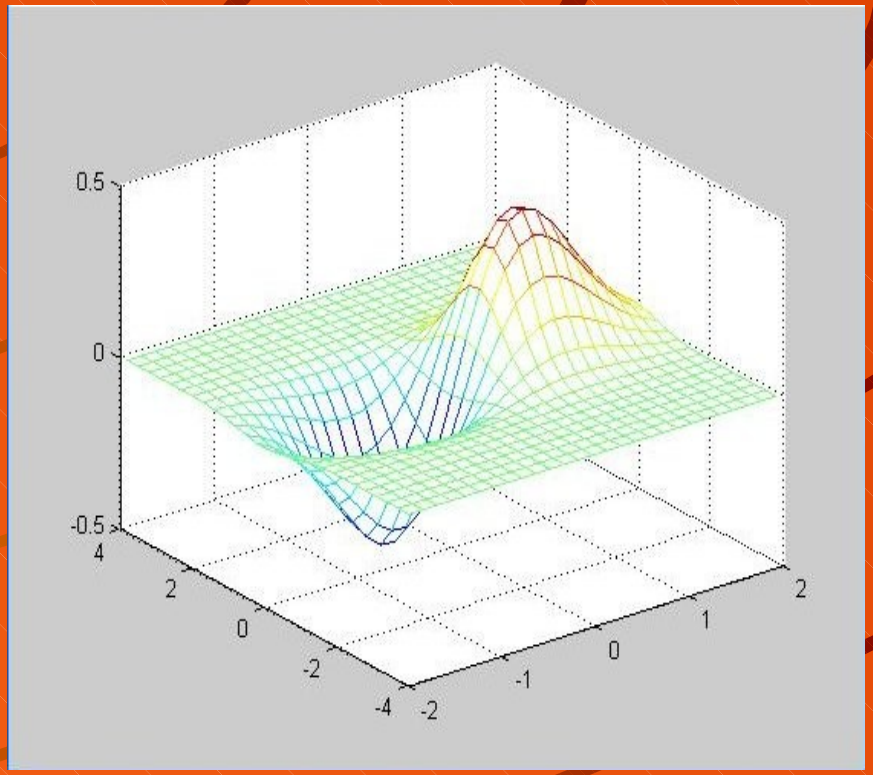
- Development Started in 1988 as a companion software for a textbook on chemical reactor design.
- Rationale: Student were spending too much effort on learning Fortran, the “Computer Language of Engineering”
- Version 1.0 in 1994 only.
- Considered as the closest “clone” of MATLAB considering the syntax

GNU Octave Compatibility overview

- In-detail comparison later in this presentation
- Actually, your m-files should works on GNU Octave out of the box as long as you do not use MATLAB-specific toolkits
- Graphical Toolkit: Gnuplot. Compatible with MATLAB 3.x graphical toolkit. (Today is MATLAB 7.x)
- Working on adding VTK (Or use Octaviz)

MATLAB Code

- [X,Y] = meshgrid([-2:.15:2],[-4:.3:4]);
- Z = X.*exp(-X.^2 - Y.^2);
- mesh(X,Y,Z)
- colormap(jet)



Scilab Code

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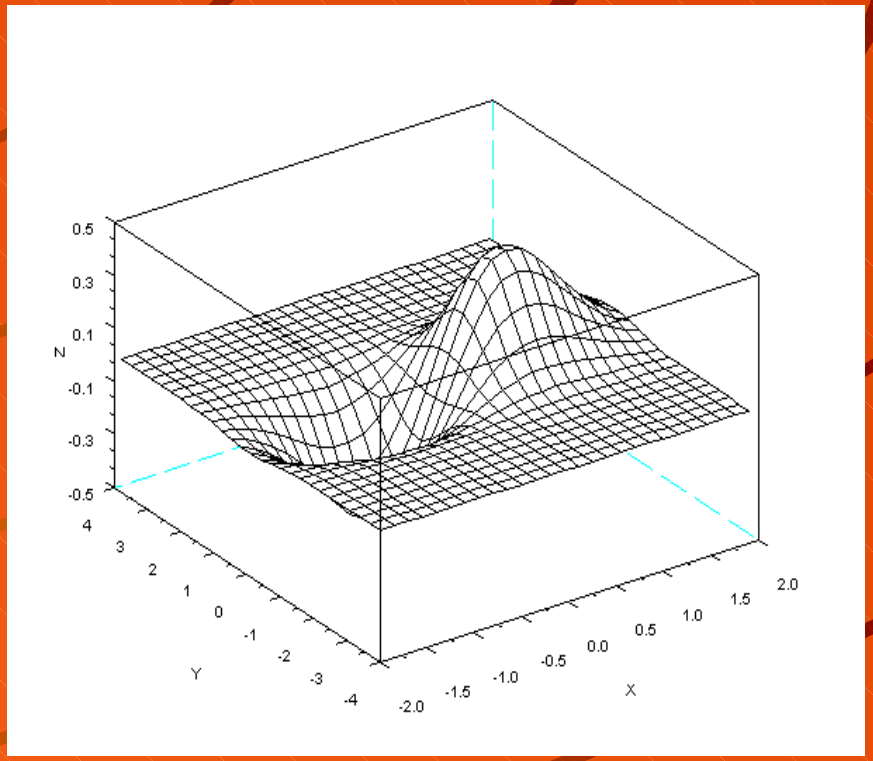
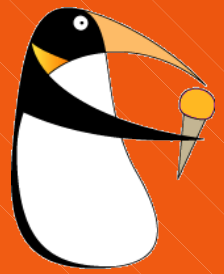




mfile2sci

- Using Scilab function **mfile2sci**

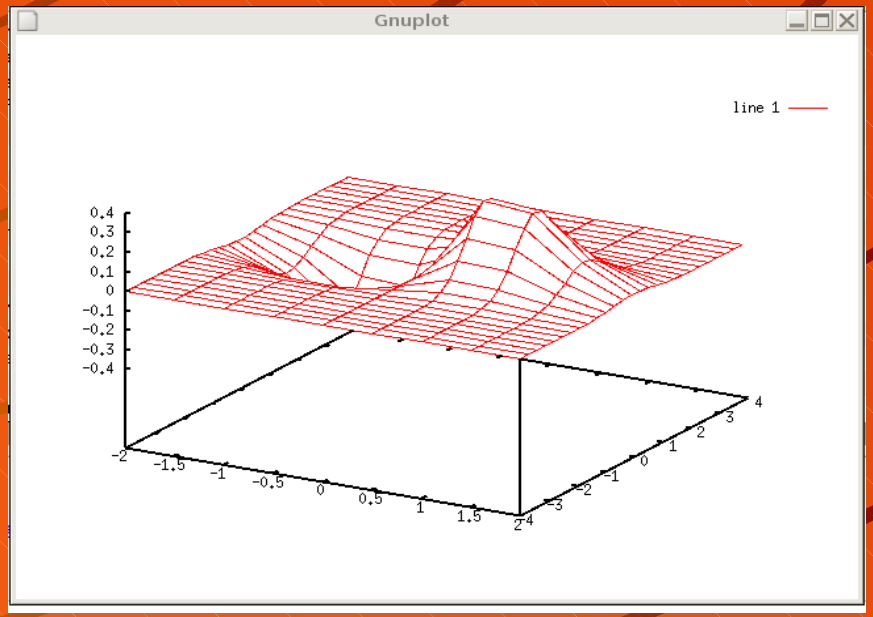
- // Display mode
- **mode(0);**

- // Display warning for floating point exception
- ieee(1);

- // !! L.1: Matlab function meshgrid not yet converted, original calling sequence used
- **[X,Y] = meshgrid(-2:0.15:2,-4:0.3:4);**
- **Z = mtlb_double(X) .*exp(mtlb_s(-mtlb_double(X) .^2,mtlb_double(Y) .^2));**
- // !! L.3: Matlab function mesh not yet converted, original calling sequence used
- **mesh(X,Y,Z)**
- // !! L.4: Matlab function jet not yet converted
- // !! L.4: Matlab function colormap not yet converted, original calling sequence used
- **colormap(mtlb(jet))**

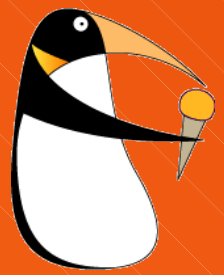
GNU Octave Code

- [X,Y] = meshgrid([-2 :.5:2],[-4:.3:4]);
- Z = X.*exp(-X.^2 - Y.^2);
- mesh(X,Y,Z)



Few Differences

	MATLAB	SCILAB	OCTAVE
Execute script	filename	exec("filename")	source("filename")
Comments	with `%'	with `%' or `#'	with: //
Graphical tool	simulink	scicos	GNU Plot
Matlab code translator		Yes(??)	NO
Boolean Variables	0,1	%t,%f	0,1
Rotate 3D Graphics	Yes	Yes	no
Support	Commercial, not free	free,1person team, techincal groups	free, Consortium, technical groups



Informal Benchmarking

- ***I. Matrix calculation:*** *evaluates the ability of performing some common matrix computations*
- ***II. Matrix functions:*** *evaluates speed of some preprogrammed matrix functions*
- ***III. Programming:*** *evaluates efficiency to run scripts and custom functions.*

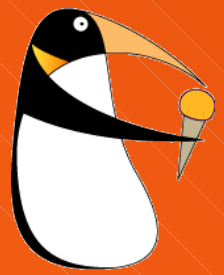
visit:http://www.sciviews.org/benchmark/index.html

Benchmark Results

Software	Itanium-2 Mckinley, 800MHz, 4GB	Pentium III 1.06GHz, 504MB
Octave-2.1,gcc	.8533 sec	2.22 sec
Octave-2.1, icc9.0	.5227	
Octave-2.1, Intel Mkl	.515	
Scilab-3.0 icc	1.80	.964
MATLAB 7.1		.873

Future Direction…

- Scilab:
  - Support of MPI
  - Integrating parallelism directly into core functionalities
- GNU Octave:
  - Port of MPI from x86 to IPF
- Both: Continuing optimization effort



Vanilla Efforts

- All these tools are “shells” for backend-libraries
- Optimized libraries for Itanium already exists (e.g. MKL, IPP…)
- Making life to users easier to switch from generic code to optimized libraries
- Likely with a ./configure –with-xxx
- Working on Frontend as well